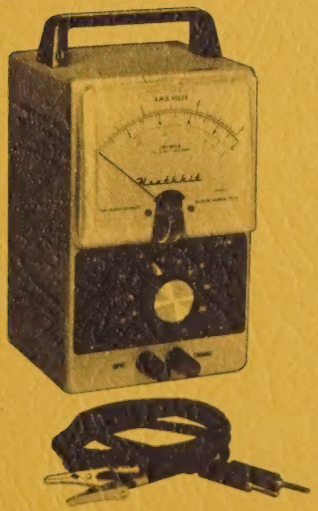
HEATHKIT®
by Daystrom



VACUUM TUBE
VOLTMETER

MODEL IMW-21

OWNER'S MANUAL

THE HEATHKIT® VACUUM TUBE VOLTMETER

MODEL IMW-21

Whether you use your new IMW-21 in a service shop, experimental laboratory, or for checking out your own high fidelity equipment as a hobby, you will find the instrument an invaluable aid. Its accuracy and dependability are indicative of the high standards set by Heath Test Instruments for over a decade of leadership.

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FEATURES

WIDE VOLTAGE RANGES: A single convenient rotary switch selects any one of 10 voltage ranges, allowing measurements of AC voltages from 1 millivolt to 300 volts.

OUTSTANDING RESPONSE: Your AC voltmeter features a frequency response of ±1 db from 10 cps to 500 kc, and ±2 db from 10 cps to 1 mc.

TOP QUALITY METER: The large, easy-to-read meter has VU type ballistics, which allow it to be used to monitor changing AC voltages, such as found in speech or music equipment.

HIGH INPUT IMPEDANCE: The 10 megohm input impedance allows the VTVM to measure voltages at even the most sensitive points, without overloading the circuits.

BUILT-IN PROTECTION: The circuit of your AC voltmeter is self-limiting...maximum current during extreme overload conditions is held well within the safety factor of the meter coil windings.

USES

AC voltages at any point in practically any type of circuit can be measured with the VTVM. Filament voltage, power line voltage, noise, output, and gain measurements can be made quickly and accurately by connecting the test leads across the point where information is desired. The VU type ballistics of the meter allow speech or music to be monitored, for recording purposes, in this same manner.

Ripple on the output of power supplies can be measured by connecting the VTVM across the supply.

Amplifier noise measurements are made by running the amplifier to full output power at a reference frequency such as 400 or 1000 cps, and then turning off the signal source, leaving it connected to the amplifier input. The reading in volts or db should be noted at full output and read again after the signal source is killed. The difference between the two readings is the noise output level in volts or db below the specified output.

OPERATION

The Model IMW-21 AC Voltmeter has 10 separate voltage ranges allowing measurements up to 300 volts rms. The voltage markings on the Range switch refer to full scale voltage readings.

When the instrument is set to the lower ranges, the meter may show a residual indication. This is caused by the extreme sensitivity of the circuit. To check for zero indication, the instrument power plug should be reversed in the AC outlet until a minimum reading is obtained. Zero reading should be evident when the input terminals are shorted together.

The meter scale is marked 0-3 and 0-10 for voltage measurements. When making measurements on the .03, .3, 3, 30 or 300 volt ranges, read the 0-3 meter scale and adjust the decimal for the correct voltage.

When making measurements on the .01, .1, 1, 10, or 100 volt ranges, read the 0-10 meter range and adjust the decimal for the correct voltage.

Due to the high sensitivity of the instrument, the input terminals should not be touched when the meter is set for the lower ranges. Stray electric fields, picked up by the human body, will deflect the pointer beyond full scale. Repeated banging may bend the pointer.

Although the pointer may bend by overloading, the electronic circuit is self-limiting. The meter may not burn out from severe overloading, but other circuit components can be damaged by prolonged overloads.

USING THE DECIBEL SCALE

Because the human ear does not respond to the volume of sound in proportion to the signal strength, a unit of measure called the "bel" was adopted. The "bel" is more nearly equivalent to human ratios. Normally the reading is

given in 1/10 of a "bel" or "decibel." Different signal levels are adopted by various manufacturers as standard or "0" decibels. The trend within the last few years has been toward the use of 1 milliwatt into a 600 Ω load as "0" db. This reference has been given a special designation of "dbm." Your VTVM is calibrated to read in "dbm" when connected across a 600 Ω load.

When using the AC voltmeter for db measurement, adjust the Range switch until there is a reading on the decibel scale. The meter reading is then either added to or subtracted from the switch setting.

EXAMPLE:

Range +20 db, meter indicates - 5 db; actual value is +15 db. Range -10 db, meter indicates -4 db; actual value is -14 db.

Since the decibel is a power ratio or voltage ratio, it may be used as such without specifying the reference level. Thus, for instance, a fidelity curve may be run on an amplifier by feeding in a signal of variable frequency but constant amplitude. At a reference frequency of, say 400 cps, make an initial reading on the AC voltmeter, connected to the output. A suitable load, such as a speaker, should be connected to the amplifier output during the test. As the input frequency is varied, amplitude held constant, the output level variation may be noted in db above and below the specified reference level.

If the input impedance is the same as the output impedance, the db gain can be measured directly with the Voltmeter. In the case where the input and output impedance differ, it is necessary to correct each reading mathematically to a common reference level.

COMPLEX WAVEFORMS

This instrument, like most AC voltmeters, is calibrated to read the Root Mean Square (rms) value of a pure sine wave. This is 70.7% of the peak voltage.

As is characteristic of most rectifier type instruments, the meter deflection is proportional to the average value of the input waveform. Thus, when measuring odd-shaped waves (square, sawtoothed, pulse), the meter reading must be given special interpretation. Special reading on this subject will be found in tests concerning AC measurements.

SPECIFICATIONS

Frequency Response:

±1 db from 10 cps to 500 kc, all ranges.
±2 db from 10 cps to 1 mc, all ranges.

Ranges:

Ten ranges, marked both in volts and db.

Volts:

.01, .03, .1, .3, 1, 3, 10, 30, 100, 300 volts rms full scale.

Decibels:

-40, -30, -20, -10, 0, +10, +20, +30, +40, +50 db (0 db is equal to 1 milliwatt in 600 Ω).

Input Impedance:

10 megohms shunted by 12 μμf on all ranges from 10 volts to 300 volts.
10 megohms shunted by 22 μμf on all ranges from .01 volt to 3 volts.

Power Requirements:

105-125 volts, 50/60 cps AC, 10 watts.

Dimensions:

7-3/8" high x 4-11/16" wide x 4-1/8" deep.

Accuracy:

Within 5% of full scale.

Net Weight:

3 lbs.

ADJUSTMENT

Your VTVM is factory adjusted. If calibration becomes necessary in the future, use the following instructions.

For maximum accuracy, use an accurate AC voltmeter, and/or an accurate AC voltage source to calibrate your VTVM. If these are not available, you can make an approximate calibration by using your 117 volt power line voltage as a calibrating source.

LINE VOLTAGE CALIBRATION

1. Before turning the VTVM on, adjust the

meter needle to be exactly over zero on the front panel by turning the small screw near the bottom center section of the meter face.

2. Turn on your VTVM by turning the Range switch to the 300 volt range. Allow it to operate for fifteen minutes for a thorough warmup period.

3. Connect the test leads of the VTVM to the 117 volt power line.

(CAUTION: A 117 volt line is dangerous. Proceed with care. Hold only one lead at a time.)

4. Remove the plastic control guard and adjust the calibrate control so the meter needle indicates 117 volts. Disconnect the leads from the 117 volt power line.

5. Replace the plastic control guard.

6. Remove the cabinet and turn the trimmer capacitor (on the Range switch) to the position shown in Figure 1. This compensates the input voltage divider approximately for frequencies throughout the range of the VTVM. Replace the cabinet.

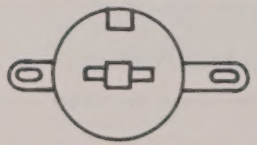

Figure 1

INSTRUMENT CALIBRATION

1. Set the IMW-21 Range switch to the 3 volt range.

2. Connect a 1000 cps, 3 volt signal to the inputs of both the IMW-21 and the other accurate AC voltmeter. Adjust the calibration control of the IMW-21 so the meter indicates the same voltage as the other accurate AC voltmeter.

3. Remove the cabinet and turn the Range switch to the 10 volt range. Adjust the trimmer capacitor (on the Range switch) so that the meter indicates exactly the same voltage as on the 3 volt range.

This completes the adjustment. Replace the cabinet.

REPLACEMENT PARTS

The following list includes only those parts which may be difficult to obtain locally if replacement is required.

PART No.	DESCRIPTION
Resistors	
1-49	22 Ω 1/2 watt
1-103	33 Ω 1/2 watt
1-1	47 Ω 1/2 watt
1-118	82 Ω 1/2 watt
1-3	100 Ω 1/2 watt
1-13	2700 Ω 1/2 watt
1-20	10 KΩ 1/2 watt
1-25	47 KΩ 1/2 watt
1-60	68 KΩ 1/2 watt
1-27	150 KΩ 1/2 watt
1-33	470 KΩ 1/2 watt
1-35	1 megohm 1/2 watt
1-40	10 megohm 1/2 watt
2-159	100 Ω precision
2-25	216.2 Ω precision
2-28	683.8 Ω precision
2-31	2162 Ω precision
2-33	6838 Ω precision
2-39	21.62 KΩ precision
2-17	10 megohm precision
2-50	10 KΩ precision
Capacitors	
20-71	.0013 μfd mica (1300 μμf)
20-75	.005 μfd mica (5000 μμf)
21-47	.01 μfd disc ceramic
21-31	.02 μfd disc ceramic
23-28	.1 μfd tubular
27-19	1 μfd mylar
25-39	2 μfd 150 volt electrolytic
25-95	10 μfd electrolytic, 25 volts
25-23	20-40-80 μfd electrolytic, 150 volts
31-13	3-12 μμf trimmer
Control-Switch-Transformer	
11-16	40 Ω control
63-283	Range switch, 11-position
54-2	Power transformer

PART No.	DESCRIPTION
Tubes-Lamp-Diodes	
411-96	6AW8 tube
411-160	6EJ7/EF184 tube
412-1	#47 lamp
56-4	Crystal diode
57-23	Silicon rectifier

WARRANTY

Heath Company warrants that for a period of three months from the date of purchase, the equipment referred to in this manual shall be free of defects in materials and workmanship under normal use and service and that in fulfillment of any breach of such warranty, Heath Company shall replace or repair defective parts or equipment upon their return to its factory. The foregoing warranty shall apply only to the original buyer, and is and shall be in lieu of all other warranties, whether expressed or implied and of all other obligations or liabilities on the part of Heath Company and in no event shall Heath Company be liable for any anticipated profits, consequential damages, loss of time or other losses incurred by the buyer in connection with the purchase or operation of Heath products or components thereof. No replacement shall be made of parts damaged by the buyer.

HEATH COMPANY

The foregoing Warranty applies expressly to Direct Mail Customers with reference to Heath Company factory service and parts replacements.

If your unit was purchased through a local authorized Heath dealer, all sections of this Warranty will be honored by such dealer.

HEATH COMPANY

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